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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/889,518
Filing Date: August 27, 2001
Appellant(s): BAIER ET AL.

KEVIN R. SPIVAK
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed on 06/21/2004.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The rejection of claims 1-5, 8-13, 16-22 and 27 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

6,009,124	SMITH ET AL.	12-1999
6,333,947	VAN HEESWYK ET AL.	12-2001
6,144,711	RALEIGH ET AL.	11-2000

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-2, 17 and 27 are rejected under 35 U.S.C. 102(e) and claims 3-5, 8-13, 16, 18-22 are rejected under 35 U.S.C. 103(a). This rejection is set forth in prior Office Action, mailed on 05/01/2003 and the rejection is maintained in the Final Rejection, mailed on 10/21/2003, and repeated below, with additional details added, for the convenience of the Board.

Before answering appellant's argument, it is worthwhile to review the problem being addressed by applicant's invention. The problem being addressed, in general, is related to a receiver, having one or more receiving antenna, receives a signal being corrupted though a transmission channel. Appellant claims a method of utilizing information on received interference signals to improve the quality of transmission of the data transmission, obtaining quantitative information about received user signals from the received signals of one of the antennas by using a first signal processing algorithm, and obtaining quantitative information about the received interference signals from the received signals of one of the antennas and the quantitative information obtained about the received user signals by using a second signal processing algorithm wherein the

quantitative information about the received interference signals is used to generate a directional pattern at the transmitter.

The examiner's position is that the prior art references cited, applied to the same field of endeavor, anticipates all of the limitations of the claimed subject matter in the 35 U.S.C. 102(e) rejection, and teaches all of the limitations of the claimed subject matter including motivation for combining them in the 35 U.S.C. 103(a) rejection, as explained in the prior Office action and repeated below in "Response to Argument".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 17 and 27 are rejected under 35 U.S.C. 102(e) as being anticipated by Smith et al. U.S. Patent 6,009,124.

Regarding claims 1 and 27, according to the teachings of Smith invention, in column 3, lines 23-36, ***an interference reduction circuit***, which is coupled to an adaptive sectored antenna, ***selectively moves the sector of coverage to alternative configurations to reduce the external interference based on interference***

indication signals which are the BER (bit error rate) ***and the RSSI*** (Received Signal Strength Indicator). Hence, Smith invention utilizes the interference indication signals to steer the antennas ***to receive and, of course, transmit data and the quality of data transmission would be improved by achieving spatial selectivity to focus on one of the users and reject signals from all other users in the environment***. Figure 6 shows a high data rate communication system including base stations 602 and 604 wherein each base station employs an adaptive sectored antenna 614 or 624 and a beam steering state machine 200. Figure 8 illustrates the processing steps for a protocol between the first base station 602 and the second base station 604. In processing step 800, the first base station transmits an ID signal to a second base station. The second base station comes out of standby mode and transmits an antenna training sequence to the first base station. Hence, the first base station processes the training sequence, by using a signal-processing algorithm, to obtain quantitative information about the second base station. In processing step 808, the first base station and the second base station adaptively steer their respective arrays to achieve minimum BER and a maximum RSSI that are interference indication signals. Hence, as recited again, the quantitative information about the received interference indication signals are utilized to steer the antenna and, of course, is used to generate a directional pattern for transmission at the first base station.

Regarding claim 2, the measurement of RSSI signal as taught in Smith invention should be a good estimate of the transmitted user data. Hence, the RSSI measurement could be part of the first signal-processing algorithm.

Regarding claim 17, one embodiment of Smith et al. invention is a communication between two base stations, a single user detection case.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3-5 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith et al. U.S. Patent 6,009,124 as applied to claim 1 above, and further in view of Van Heeswyk et al. U.S. Patent 6,333,947 B1.

Regarding claim 3, Smith et al. does not explicitly provide an estimate of the characteristics of the radio channels. Nevertheless, the RSSI signal measurement inherently embeds the radio channel characteristics. As well known in the art, channel characterization is always performed at the receiver to take into account estimated channel response. Also, as demonstrated in Van Heeswyk invention, in figure 6, an interference cancellation circuit 115 includes a pilot channel detection and air interface channel characterization 200 to perform an estimate of an air interface channel over which the signal components are transmitted. Although Van Heeswyk invention does not show utilization of interference information to improve the transmission quality at the receiver, Van Heeswyk teaches a method of canceling interference in CDMA signals

wherein an air channel is characterized using a pilot signal. The information of channel characterization is directly related to the computation of the RSSI signal. Therefore, implementing an interference cancellation circuit as taught by Van Heeswyk into Smith et al.'s high data rate communication system for reducing interference would have been obvious to one of ordinary skill in the art.

Regarding claim 4, with the foregoing same reasons, Van Heeswyk further discloses digitized baseband pilot channel component reconstruction 202 subtracted from the delayed digitized baseband component signals 119 to recreate corrected digitized baseband component signals 207, see figure 6. Hence, Van Heeswyk teaching is considered a second signal-processing algorithm to reconstruct the user signals as stated in the claim.

Regarding claim 5, with the foregoing same reasons, Van Heeswyk further discloses, in figure 9, an amplitude weighting function 270 is used to affect the estimated amplitude for the particular path. The ouput of the amplitude weighting function 270 is an estimate of the particular digitized baseband pilot channel component. The result can be applied to the subtraction circuit 205 as recited in claim 4 to reconstruct the received user signals. Hence, this portion of Van Heeswyk teachings can be considered to be part of a second signal-processing algorithm as stated in the claim.

Regarding claim 18, Van Heeswyk's invention is for multi-user system as illustrated in figure 6.

Regarding claim 19, Van Heeswyk's invention is for multi-user system employing RAKE receiver as illustrated in figure 7.

Regarding claim 20, forward error correction encoding/decoding are inherently employed in the communications system.

Claims 8-13, 16, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith et al. U.S. Patent 6,009,124 as applied to claim 1 above, and further in view of Raleigh et al. U.S. Patent 6,144,711.

Regarding claim 8, Smith et al. does not teach the second signal processing algorithm includes a forming of the spatial covariance matrix of the received interference signals. Nevertheless, Raleigh et al. invention is directed to a space-time signal processing system, taking advantage of multiple transmitter antenna elements and/or multiple receiver antenna elements. The system, as illustrated in figure 14, operates with an efficient combination of substantially orthogonalizing procedure (SOP) that decomposes the time domain space-time communication channel that might have intersymbol interference (ISI) into a set of parallel, space-frequency, SOP bins wherein the ISI is substantially reduced. Raleigh et al. further teaches a preferable measure of the interference present is the so-called interference spatial covariance matrix, which describes interference correlation across space for each frequency bin. The forming of covariance functions can be considered to be part of the second signal-processing algorithm. Even though Raleigh et al does not show utilization of interference information to improve the transmission quality at the receiver, nevertheless, the

forming of an interference spatial covariance matrix as taught by Raleigh et al. fits well in the teachings of Smith et al. for combating multi-path interference; therefore, the combination of both teachings would have been obvious to one of ordinary skill in the art.

Regarding claim 9, Raleigh et al. invention is directed to a "*space-time*" signal processing system, taking advantage of multiple transmitter antenna elements and/or multiple receiver antenna elements. Hence, the forming of covariance functions of the received interference signals is obviously both spatial and temporal. The forming of covariance functions can be considered to be part of the second signal-processing algorithm.

Regarding claim 10, the forming of covariance functions of the received interference signals obviously includes the total covariance functions of the received interference signals and the process can considered to be part of the second signal-processing algorithm.

Regarding claim 11, Raleigh et al. discloses that the interference covariance matrix contains information about the average spatial behavior of interference. It should be very well known in the art averaging is always performed over a period of time to better characterize noise or interference. Therefore, it would have been obvious that the "*space-time*" signal processing system as taught by Raleigh et al. would estimate the spatial,temporal and/or total covariance functions by finite temporal averaging over the received interference signals.

Regarding claim 12, Raleigh et al. discloses forming an interference spatial covariance matrix, which describes interference correlation across space for each frequency bin. The eigenvalues of the matrix indicate the average power occupied by the interference in each the eigendirection. The eigendirections that are associated with large eigenvalues indicate spatial directions that receive a large amount of average interference power. The eigendirections that are associated with small eigenvalues indicate spatial directions that receive a less average interference power. Hence, the information in the matrix includes estimated directions of incidence of the interference.

Regarding claim 13, Raleigh et al. teaches the forming of an interference spatial covariance matrix, which describes interference correlation across space for each frequency bin. The eigen-values of the matrix indicate the average power occupied by the interference in each of the eigen-directions. Hence, the eigenvalues of the matrix indicate the estimated average power occupied by the interference in each of the eigendirection.

Regarding claim 16, since received signals are received interference signals, forming a spatial covariance matrix of interference signals is also forming a spatial covariance matrix of the received user signals. Hence, the process can be part of the first signal processing.

Regarding claim 21, Raleigh et al. discusses, column 18, lines 8-45, a zero-forcing method for determining the weighting matrix in a matrix channel in one embodiment in the invention.

Regarding claim 22, Raleigh et al. discloses, in figure 3, the output of a receiver space-frequency processor 140 fed into Decoder and Deinterleaving block 150. A preferred embodiment includes a deinterleaver, a trellis decoder or a convolutional bit map decoder employing a scalar weighted Euclidean maximum likelihood sequence detector. Hence, the first signal processing algorithm can be considered based on the maximum likelihood estimation.

(11) Response to Argument

(a) In addressing (1) (i.e. in the Appeal Brief, pages 6, 8, 9), appellants argue that reference Smith et al. does not use user signals, but rather a training sequence. The appellants further reiterates that the term user signals as used in the claims are understood by the skilled artisan as meaning signals which represent data useful for the end user of the communication device in use. The appellant further argues that since the RSSI is obtained from a training sequence, Smith et al. reference does not obtain quantitative information about received user signals.

- The examiner responds that this argument is not persuasive. As explained in the Final Office Action, Smith et al. (US 6,009,124) teaches in figure 7 a protocol employed by a base station and mobile unit to communicate data there between and in figure 8 another protocol employed by a first base station and a second base station (in place of the mobile unit in figure 7) to

communicate data there between. On the contrary to appellants' assertion, the term user signals are signals (including training signals as taught by Smith et al.) transmitted from a user (the mobile unit in figure 7, and the second base station in figure 8) and received at a receiver (the base station in figure 7 and the first base station in figure 8) as understood by one of ordinary skill in the art of communications system since there are no specific user signals described in the claim. As also disclosed in the summary of the invention in Smith et al. reference, column 2 lines 18-21, a radio transceiver selectively generates a bit error rate (BER) signal and a receive signal strength indication (RSSI) signal based upon a received antenna training sequence, which is a received user signal. Clearly, the receive signal strength indication (RSSI) signal is the claimed quantitative information about received user signals. In view of the examiner reasoning, Smith et al. reference teaches the claimed subject matter (1).

(b) In addressing (2) (i.e. in the Appeal Brief, pages 6, 9), appellants argue that Smith et al. uses the BER and the RSSI, Smith does not disclose obtaining quantitative information about the received interference signal. Later on, appellants admits that even if the RSSI somehow implicitly contains information about the received interference signal, this information is definitely not obtained in a way similar to the claimed invention. Appellants further argue that the

information about the interference signal is not only obtained from the received signal, but additionally from the information about the received user signals.

- Appellants' arguments are not persuasive for the following reasons. As stated in the previous Office action and the Final Rejection, also in column 4 line 65 through column 5 line 3, Smith et al. expresses the adaptive antenna of the present invention implements a beam steering algorithm that is ***based on two interference indication signals: the BER and the RSSI*** [Emphasis added]. In view of that, the BER and RSSI are representative of quantitative information about the received interference signals, and as recited above, both BER and RSSI are generated based upon a received antenna training sequence, which is a received user signal. Furthermore, since the BER and the RSSI are two interference indication signals, clearly, the quantitative information about the interference signals is not only obtained from the received signal, but additionally from the information about the received user signals. In view of that, Smith et al. invention teaches the claimed subject matter (2).

(c) In addressing (4) (i.e. in the Appeal Brief, pages 7-9), appellants argue that the steering process of Smith et al. tries to guarantee that certain signal quality for reception of signals, and nowhere does Smith et al. mention steering the antennas for better transmission.

- Appellants' arguments are not persuasive. As disclosed in the abstract of Smith invention, the high data rate communication system includes ***an antenna subsystem for receiving and transmitting data*** **[Emphasis added]**. Also, shown in figure 7, step 714, data is transmitted between base station (BS) and mobile unit (MU) after adaptive array antenna steers to achieve a minimum BER and maximum RSSI in step 708; shown in figure 8, step 812, data is transmitted between base station 1 (BS1) and base station 2 (BS2) after BS1 and BS2 steer adaptive array antenna to achieve a minimum BER and maximum RSSI in step 808. <u>*Admitted on page 29 of appellants' Preliminary Amendment, if multi-antenna systems are used for receiving and transmitting, the information about the received interference can be used for advantageously driving the antennas in the transmitting case*</u>. Figure 4 further shows Smith et al. transceiver having the same antenna subsystem 400 for reception and transmission, the transceiver employing ***an antenna controller 38 coupled to a modulator to drive the antenna subsystem 400 for transmission***. Smith et al. system is a transceiver using the same antenna subsystem for receiving and transmitting high speed data, wherein the antenna subsystem adaptively steers based on the two received interference indication signals BER and RSSI, contrary to Appellants' assertion that the steering process of Smith et al. tries to guarantee that certain signal quality for reception of signals. In view of that, Smith et al. invention teaches the claimed subject matter (2).

(d) In addressing (3) (i.e. in the Appeal Brief, page 7), appellants argue that the BER and RSSI are used by Smith et al. not to generate a directional pattern, but to bring about a decision whether to change the direction of the antenna or not, and the BER and RSSI are only decision parameters.

- The Examiner disagrees with appellants' arguments. As recited in (c), Smith et al. system is a transceiver using the same antenna subsystem for receiving and transmitting high speed data, wherein the antenna subsystem adaptively steers based on the two received interference indication signals BER and RSSI for better reception/transmission. Figure 4 illustrates Smith et al. transceiver having the same antenna subsystem 400 for reception and transmission, the transceiver employing ***an antenna controller 38 coupled to a modulator to drive the antenna subsystem 400 for transmission***. Also, <u>*admitted on page 29 of appellants' Preliminary Amendment, if multi-antenna systems are used for receiving and transmitting, the information about the received interference can be used for advantageously driving the antennas in the transmitting case*</u>. Contrary to appellants' arguments, Smith et al. transceiver utilizes the quantitative information about the received interference signals to also generate a directional pattern for transmission. In view of the examiner's reasoning, Smith et al. invention teaches the claimed subject matter (3).

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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